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LISTS OF SPECIES

# Angiosperms of Nanmangalam Reserve Forest, an urban forest in Metropolitan Chennai, India

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**ABSTRACT:** Humans have altered the forests of urban regions drastically, thereby reducing the original forests to isolated fragments. Such fragments may contain remnants of the original vegetation. Nanmangalam Reserve Forest (NRF), located in the Metropolitan Chennai, Tamil Nadu, India, is an example of such a forest fragment, covering an area of 321 ha. A total of 449 angiosperm species belonging to 313 genera representing 83 families were recorded from NRF. Amongst the species, 79% were dicots and 21% were monocots. The most genera/species rich families were Fabaceae (37/69) and Poaceae (34/52). The species rich genera included *Cassia* (10), *Crotalaria* (7), *Erogrostis*, *Hedyotis* and *Phyllanthus* (6 each). Six endemic species were recorded. This diversity amidst a rapidly expanding city has to be protected in order to enable the conservation agenda of urban areas.

## INTRODUCTION

Urban woodlands in long-settled parts of the developed world can provide an opportunity to undertake experiments on the ability of human impacted systems to maintain biodiversity, while at the same time offer a glimpse into the historical processes of ecological change and species loss due to human activity (Drayton and Primack 1996). In almost all urban forests worldwide, the maintenance of diversity has been passive, that is, the land was not chosen explicitly for biodiversity, but was driven by other considerations. These types of areas have been called *ad hoc* biological reserves (Pressey 1994).

Forests in urban landscapes are vulnerable to *ad hoc* human activities that are broadly described as 'developmental activities'. As a result of such intense human activities, the once extensive and contiguous forested areas of urban regions are now confined to small isolated fragments, often supporting remnants of the past vegetation along with exotics (Chazdon 2003). Studies on the role of remnant vegetation indicate that such patches and their vegetation can play a critical role in the conservation of relict and native species in the urban environment (Drayton and Primack 1996; Chazdon 2003; Ramanujam and Cyril 2003; Kenichi *et al.* 2006). Further, isolated forest fragments are known to act as a seed banks for native species and provide suitable habitats for endemic and rare species. These patches are often the sole refuge for a wide-range of organisms in the urban areas (Chazdon 2003).

Ehrlich and Murphy (1987) emphasized that studies on remnant forests should focus on the process of local extinction of the species and their recovery processes. Drayton and Primack (1996) state that studies focusing on documentary evidence of flora, vegetation features, forest utilization and land use patterns in forests are important to determine the i) rate of species turn-over over a period of time, ii) persistence of native species in a fragmented forest landscape and iii) species prone to local extinction due to various natural and anthropogenic pressures. Exploring and understanding species diversity of remnant forests could therefore be the primary scientific approach towards classification of these forests. Documentation of the patterns of species diversity and distribution provides a strong database for formulating and implementing management and conservation measures (Pragasan and Parthasarathy 2009).

This study was conducted to inventory the angiosperm diversity of Nanmangalam Reserve Forest (NRF), an urban forest on the East Coast of India.

## MATERIALS AND METHODS

### *Study area*

The city of Chennai (erstwhile Madras), located on the East Coast of India, is the capital of the Indian State of Tamil Nadu and the 34$^{th}$ largest city in the world. The growth of the native and immigrant population, urban commercial, industrial and educational facilities, and Information Technology and allied services are the major driving force behind the rapid expansion of the city. This historical city has been subjected to continued yet varying intensities of anthropogenic activities, notably increased infrastructure and conversion of land and water bodies to human settlements. Champion and Seth (1968) observed that the forests in this landscape have been influenced by felling, lopping and browsing, resulting in irregular forests with open patches. The thorny and unpalatable species in these open patches were considered by them to depict the climax vegetation.

The Nanmangalam Reserve Forest (NRF), Chennai, has an expanse of 321 ha (12°55'5" N to 12°56'13" N

and 80°9'46" E to 80°10'57" E; central coordinate of the reserve at 12°55'43" N and 80°10'30" E) and is considered part of what is designated as South Chennai (Figure 1). NRF encompasses habitats such as hillocks, plains with scrub forest, *Eucalyptus* plantations of the Department of Forests, seasonal flood plains, abandoned quarries with water throughout the year and two fresh water ponds (Figure 2). The soil type of NRF is described as red loamy and rocky. Average annual rainfall ranges between 1200 mm and 1500 mm, with an annual average precipitation of 1317.3 mm. Decadal temperature ranges between 20°C and 45°C, with an annual mean temperature of 28.6°C.

*Data Collection*

Field trips were made during a nine month period (August 2008 - April 2009) ensuring that the dry and monsoon seasons were accommodated. Since the NRF is a protected area we had a limited permission to collect plant specimens. Therefore, voucher specimens were collected only when species identification was not possible in the field and were deposited in Care earth trust. The collected specimens were identified and authenticated with the help of valid references (Henry *et al.* 1987; Henry *et al.* 1989; Gamble and Fischer 1921–1935; Matthew 1991; Bor 1960; Janarthanam and Henry 1992; Livingstone and Henry 1994) and further validated through herbarium referencing at the Botany Department, Madras Christian College. Angiosperm phylogenic group II was followed to classify the species. Nomenclature and author citation for all the species were thoroughly checked in Tropicos (2012) data base.

## Results and Discussion

In total, 449 species and 4 varieties of angiosperms belonging to 313 genera representing 83 families were recorded for NRF (Table 1). Photographs of selected species are given in Figure 3-9. Among the species recorded, 79% were dicots and 21% were monocots. Fabaceae (69 species, 37 genera) and Poaceae (52 species, 34 genera) are the two most species and genera rich families. About 50% of the genera and species were from 10 dominant families. Thirty-three families were represented by a single species and 40 families were represented by a single genus. The genera richness was high in *Cassia* (10 species), *Crotalaria* (7 species), *Erogrostis, Phyllanthus* and *Hedyotis* (6 species each).

Habit-wise classification reveals that herbs (39%) are predominant, followed by trees (15%) and shrubs (14%). Others like grasses (12%), climbers (9%) and under-shrubs (6%) also contributed towards the species richness, but lianas (2%) and sedges (3%) were poorly represented. Due to seasonal flooding and the presence of fresh water ponds, NRF harbors about 13% (n = 55) of aquatic (20%) and semi-aquatic species (80%).

The NRF is mostly covered by thickets of shrubs intermixed with *Eucalyptus* plantation. About 28% of the arborescent taxa present in NRF are armed (Figure 7). The dominant arborescent plants of NRF are *Ziziphus xylopyrus, Acacia planifrons, Atalantia monophylla, Canthium parviflorum, Catunaregam spinosa, Scutia myrtina, Benkara malabarica* and *Ziziphus oenoplia.* High anthropogenic pressure, browsing and lopping are the presumable reasons for the occurrence of more number of armed arborescent species (Figure 10).

The presence of locally rare species, such as *Utricularia caerulea, Utricularia graminifolia, Utricularia polygaloides, Utricularia scandens*, *Drosera burmannii, Drosera indica*, *Habenaria viridiflora* and *Osbeckia zeylanica* in the seasonal flooding areas of *Eucalyptus tereticornis* plantation (Figure 2C) is a noteworthy observation. Although the plantation area supports less ground cover, these rarely occurring herbaceous species are found

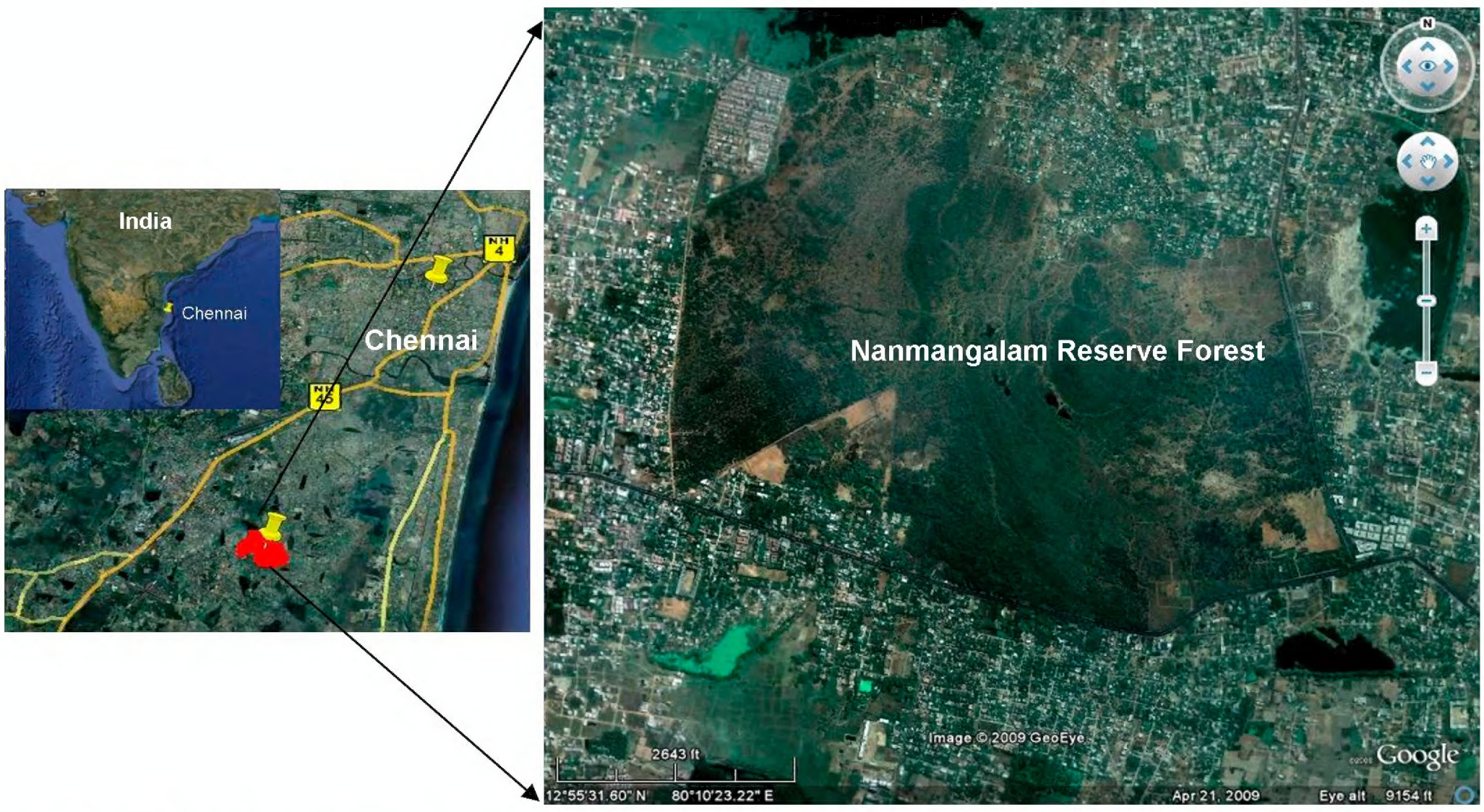


**Figure 1.** Map of the Nanmangalam Reserve Forest.

commonly within this plantation. While plantations of *Eucalyptus* spp. were reported to have a negative effect on the regeneration of native species (Gareca *et al.* 2007; Zhang and Shenglei Fu 2009), within NRF the plantation seems to be supportive. Plausibly, the shade created by the *Eucalyptus* canopy is favoring the survival of these moist loving plants by keeping the floor wet for long period of time. In contrast, at places where shrubs predominant, floor gets dry much faster because of the opened canopy. Six endemic species were recorded, of which five are endemic to Peninsular India and Sri Lanka (*Leucas diffusa, Cymbopogon travancorensis, Cynodon barberi, Euphorbia corrigioloides* and *Chrysopogon asper*). The grass species, *Dimeria acutipes,* is endemic to Kancheepuram District, Tamil Nadu.

The once common terrestrial orchid, *Eulophia epidendraea* (Figure 3C), now considered locally extinct from Chennai, is found profusely in a hillock and foothills of NRF. Trees like *Lepisanthes tetraphylla, Buchanania axillaris, Santalum album* and *Manilkara hexandra*, once known to be common and now found only in the protected forests in the landscape of the Coromandel Coast, were also recorded in NRF. These occurrences highlight the role of NRF as a refuge for remnant species, and eventually as a seed bank for the recovery of forests.

The present study has recorded 149 woody species from NRF, which is equal to the number of woody species recorded by Parthasarathy *et al.* (2008) during their extensive study covering 75 forest fragments on the East Coast of Tamil Nadu. Other recent studies on the same forest type by various authors have recorded less number of species than in NRF (Ramanujam and Kadamban 2001; Ramanujam and Cyril 2003; Reddy and Parthasarathy 2003; Mani and Parthasarathi 2006; Udayakumar and Parthasarathy 2010).

This isolated patch of forest not only harbors high plant diversity, but is also known to support a wide range of fauna (79 species of birds, 40 butterflies, six reptiles, five amphibians and five mammals - personal observation and will be published later). This remnant patch of forest is home to many of the locally rare plant species and repository of several plant and animal species. Further, it is one of the last remaining representatives of the natural forest in an otherwise rapidly growing city of Chennai. Large tracts of this forest were de-notified in the immediate past to provide space for educational institutions. It is recommended that urban planning exercise for the city of Chennai be undertaken with a long term vision that reconciles conservation and development goals, rather than be determined by short-term benefits.


**Figure 2.** A) A view of the dense scrub forest of NRF; B) NRF boundary and the expanding city; C) Seasonally flooding Eucalyptus plantation; D) Stone mined pits (Photos by P Nehru).


**Figure 3.** A) *Asparagus racemosus*; B) *Theriophonum minutum*; C) *Eulophia epidendraea*; D) *Habenaria viridiflora*; E) *Gloriosa superba*; F) *Iphigenia indica* (Photos by P Nehru).


**Figure 4.** Plants growing in moist areas: A) *Dopatrium junceum*; B) *Drosera indica*; C) *Utricularia polygaloides*; D) *Osbeckia zeylanica*; E) *Drosera burmannii*; F) *Lindernia oppositifolia* (Photos: A, B, C, E, F by P Nehru and D by C Arivazhagan).


**Figure 5.** Scandant herbs of NRF: A) *Rhynchosia aurea*; B) *Desmodium triflorum*; C) *Blepharis maderaspatensis*; D) *Blepharis repens*; E) *Portulaca suffruticosa*; F) *Evolvulus alsinoides* (Photos by P Nehru).

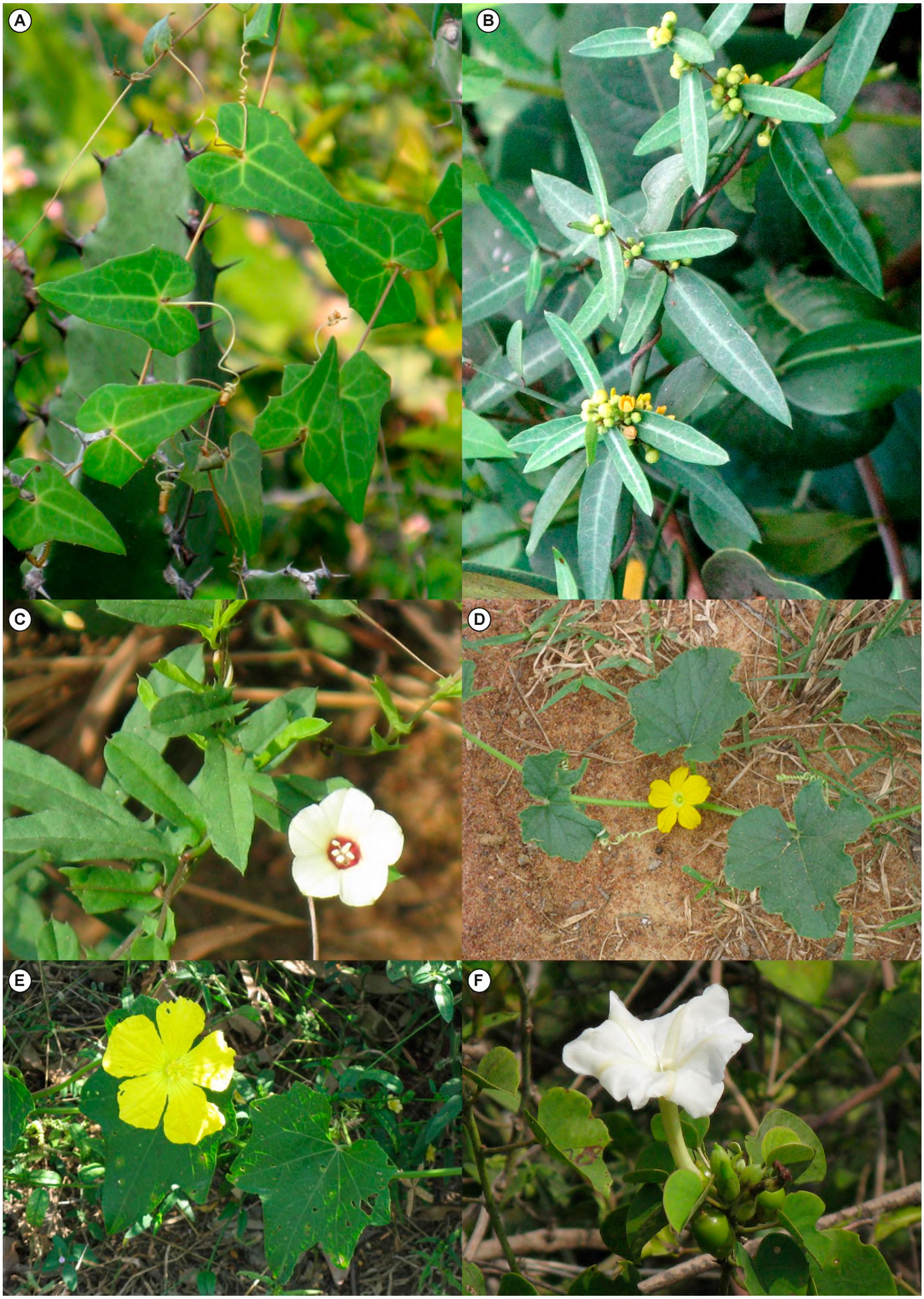


**Figure 6.** Climbers of NRF: A) *Solena amplexicaulis*; B) *Hemidesmus indicus*; C) *Merremia tridentata*; D) *Cucumis melo*; E) *Luffa cylindrica*; F) *Rivea hypocrateriformis* (Photos by P Nehru).


**FIGURE 7.** Common armed shrubs of NRF: A) *Capparis brevispina*; B) *Capparis zeylanica*; C) *Benkara malabarica*; D) *Canthium parviflorum*; E) *Maytenus emarginata*; F) *Flacourtia indica* (Photos by P Nehru).


**Figure 8.** Shrubs of NRF: A) *Dodonaea viscosa*; B) *Grewia hirsuta*; C) *Carmona retusa*; D) *Breynia vitis-idaea*; E) *Memecylon edule*; F) *Cassia auriculata* (Photos by P Nehru).


**Figure 9.** Trees of NRF: A) *Ziziphus xylopyrus*; B) *Atalantia monophylla*; C) *Buchanania axillaris*; D) *Santalum album*; E) *Morinda pubescens*; F) *Psydrax dicoccos* var. *dicoccos* (Photos: A, B, C, E, F by P Nehru and D by N Muthu Karthick).


**Figure 10.** Anthropogenic pressures: A) broom grass collection; B) fuel wood collection; C) medicinal plant collection; D) garbage dumping on the margins of NRF; E) cattle grazing; F) pathways frequently used by humans (Photos by P Nehru).

**Table 1.** List of angiosperms recorded from the Nanmangalam Reserve Forest (H - Herb; G - Grass; S - Sedge; CL - Climber; L - Liana; SH - Shrub; US - Under shrub; T - Tree; A - Armed; UA - Unarmed; *- Planted species; # - Specimen that could not be collected due to permission issues).

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Acanthaceae | *Andrographis echioides* Nees | H | UA | # |
| | *Andrographis paniculata* (Burm. f.) Wall. ex Nees | H | UA | # |
| | *Asystasia gangetica* (L.) T. And. | H | UA | # |
| | *Barleria prionitis* L. | US | A | # |
| | *Blepharis maderaspatensis* (L.) B. Heyne ex Roth | H | UA | # |
| | *Blepharis repens* (Vahl) Roth | H | UA | CET 414 |
| | *Dipteracanthus prostratus* (Poir.) Nees | H | UA | # |
| | *Ecbolium viride* (Forssk.) Alston | US | UA | # |
| | *Justicia adhatoda* L. | SH | UA | # |
| | *Justicia prostrata* Gamble | H | UA | # |
| | *Lepidagathis cristata* Willd. | H | UA | CET 432 |
| | *Ruellia tuberosa* L. | H | UA | # |
| | *Stenosiphonium russellianum* Nees | US | UA | CET 442 |
| Aizoaceae | *Trianthema portulacastrum* L. | H | UA | # |
| Amaranthaceae | *Achyranthes aspera* L. var. *aspera* | H | UA | # |
| | *Aerva lanata* (L.) Juss. ex Schul. | H | UA | # |
| | *Allmania nodiflora* (L.) R. Br. | H | UA | # |
| | *Alternanthera sessilis* (L.) R. Br. ex DC. | H | UA | # |
| | *Alternanthera tenella* Colla. | H | UA | CET 436 |
| | *Amaranthus spinosus* L. | H | UA | # |
| | *Amaranthus viridis* L. | H | UA | # |
| | *Gomphrena serrata* L. | H | UA | # |
| | *Pupalia lappacea* (L.) Juss. | H | UA | CET 417 |
| | *Trichuriella monsoniae* (L. f.) Bennet | H | UA | # |
| Amaryllidaceae | *Crinum viviparum* (Lam.) R. Ansari and V. J. Nair | H | UA | # |
| Anacardiaceae | *Buchanania axillaris* Ramam. | T | UA | # |
| | *Lannea coromandelica* (Houtt.) Merr. | T | UA | # |
| Annonaceae | *Annona reticulata* L. | T | UA | # |
| | **Polyalthia longifolia* (Sonn.) Thwaites | T | UA | # |
| Apocynaceae | *Calotropis gigantea* (L.) W.T. Aiton | SH | UA | # |
| | *Caralluma adscendens* (Roxb.) Haw. var. *adscendens* | H | UA | CET 410 |
| | *Carissa spinarum* L. | SH | A | # |
| | *Catharanthus roseus* (L.) G. Don | H | UA | # |
| | *Gymnema sylvestre* (Retz.) R. Br. ex Schult. | CL | UA | # |
| | *Hemidesmus indicus* (L.) R. Br. var. *indicus* | CL | UA | # |
| | *Ichnocarpus frutescens* (L.) W.T. Aiton | CL | UA | # |
| | *Leptadenia reticulata* (Retz.) Wight and Arn. | CL | UA | # |
| | **Nerium oleander* L. | SH | UA | # |
| | *Oxystelma secamone* H. Karst. | CL | UA | CET 389 |
| | *Pergularia daemia* (Forrsk.) Chiov. | CL | UA | # |
| | *Sarcostemma acidum* (Roxb.) Voigt | CL | UA | # |
| | *Secamone emetica* (Retz.) R. Br. ex Schult. | CL | UA | # |
| | *Tylophora indica* (Burm. f.) Merr. | CL | UA | # |
| | *Wattakaka volubilis* (L. f.) Stapf | L | UA | # |
| | *Wrightia tinctoria* R. Br. var. *tinctoria* | T | UA | # |
| Aponogetonaceae | *Aponogeton natans* (L.) Engl. and generic Krause | H | UA | # |
| Araceae | *Lemna perpusilla* Torr. | H | UA | # |
| | *Pistia stratiotes* L. | H | UA | # |
| | *Spirodela polyrhiza* (L.) Schleid. | H | UA | # |
| | *Theriophonum minutum* (Willd.) Baill. | H | UA | CET 415 |
| Arecaceae | *Borassus flabellifer* L. | T | A | # |
| | *Phoenix pusilla* Gaertn. | SH | A | # |
| | *Phoenix sylvestris* (L.) Roxb. | T | A | # |
| Asparagaceae | *Agave angustifolia* Haw. | SH | A | # |
| | *Asparagus racemosus* Willd. | L | A | # |
| | *Chlorophytum tuberosum* (Roxb.) Baker | H | UA | # |

**Table 1.** ***Continued.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Asparagaceae | *Sansevieria roxburghiana* Schult. f. | H | UA | # |
| Asteraceae | *Acanthospermum hispidum* DC. | H | UA | CET 445 |
| | *Ageratum conyzoides* L. | H | UA | # |
| | *Blumea aurita* (L. f.) DC. | H | UA | # |
| | *Blumea obliqua* (L.) Druce | H | UA | # |
| | *Eclipta prostrata* (L.) L. | H | UA | # |
| | *Emilia sonchifolia* (L.) DC. | H | UA | CET 418 |
| | *Epaltes divaricata* (L.) Cass. | H | UA | # |
| | *Parthenium hysterophorus* L. | H | UA | # |
| | *Synedrella nodiflora* (L.) Gaertn. | H | UA | # |
| | *Tridax procumbens* L. | H | UA | # |
| | *Vernonia cinerea* (L.) Less. | H | UA | # |
| | *Vicoa indica* (L.) DC. | H | UA | CET 437 |
| | *Xanthium indicum* J. Koenig ex Roxb. | US | UA | # |
| Bignoniaceae | *Dolichandrone falcata* Seem. | T | UA | # |
| Boraginaceae | *Carmona retusa* (Vahl) Masam. | SH | UA | # |
| | *Coldenia procumbens* L. | H | UA | # |
| | **Cordia obliqua* Willd. | T | UA | # |
| | *Ehretia pubescens* Benth. | T | UA | # |
| | *Heliotropium bracteatum* R. Br. | H | UA | CET 419 |
| | *Heliotropium indicum* L. | H | UA | # |
| Cactaceae | *Cereus pterogonus* Lem. | SH | A | # |
| | *Nopalea cochenillifera* (L.) Salm-Dyck | SH | A | # |
| | *Opuntia elatior* Mill. | SH | A | # |
| | *Opuntia stricta* var. *dillenii* (Ker Gawl.) L.D. Benson | SH | A | # |
| Capparidaceae | *Cadaba fruticosa* (L.) Druce | SH | UA | # |
| | *Capparis brevispina* DC. | SH | A | # |
| | *Capparis sepiaria* L. | SH | A | # |
| | *Capparis zeylanica* L. | SH | A | # |
| | *Crateva adansonii* DC. subsp. *odora* (Buch.-Ham) Jacobs | T | UA | # |
| Caryophyllaceae | *Polycarpaea corymbosa* (L.) Lam. var. *corymbosa* | H | UA | CET 435 |
| | *Polycarpaea corymbosa* (L.) Lam. var. *longipetala* Sriniv. and D. Naras. | H | UA | CET 434 |
| Celastraceae | *Maytenus emarginata* (Willd.) Ding Hou | SH | A | # |
| | *Reissantia indica* (Willd.) N. Halle` | SH | UA | # |
| Cleomaceae | *Cleome aspera* Koenig ex. DC. | H | UA | # |
| | *Cleome rutidosperma* DC. | H | UA | CET 438 |
| | *Cleome viscosa* L. | H | UA | # |
| | *Gynandropsis gynandra* (L.) Briq. | H | UA | # |
| Colchicaceae | *Gloriosa superba* L. | CL | UA | # |
| Combretaceae | *Anogeissus latifolia* (Roxb. ex DC.) Wall ex Bedd. | T | UA | # |
| | *Combretum ovalifolium* Roxb. | L | UA | # |
| | **Terminalia bellirica* (Gaertn.) Roxb. | T | UA | # |
| | **Terminalia catappa* L. | T | UA | # |
| | **Terminalia chebula* Retz. | T | UA | # |
| Commelinaceae | *Commelina attenuata* Vahl | H | UA | # |
| | *Commelina benghalensis* L. | H | UA | # |
| | *Cyanotis axillaris* (L.) D. Don ex Sweet | H | UA | CET 385 |
| | *Cyanotis cristata* (L.) D. Don | H | UA | # |
| | *Murdannia nudiflora* (L.) Brenan | H | UA | CET 396 |
| | *Murdannia spirata* (L.) G. Brückn. | H | UA | CET 413 |
| Convolvulaceae | *Evolvulus alsinoides* (L.) L. | H | UA | # |
| | *Evolvulus nummularius* (L.) L. | H | UA | # |
| | *Ipomoea aquatica* Forssk. | H | UA | # |
| | *Ipomoea carnea* Jacq. subsp. *carnea* | SH | UA | # |
| | *Ipomoea coptica* (L.) Roth ex Roem. and Schult. | CL | UA | # |
| | *Ipomoea pes-tigridis* L. | CL | UA | # |
| | *Ipomoea sepiaria* Koenig ex Roxb. | CL | UA | # |

**TABLE 1.** ***CONTINUED.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Convolvulaceae | *Merremia emarginata* (Burm. f.) Hallier f. | CL | UA | # |
| | *Merremia tridentata* (L.) Hall.f. | CL | UA | # |
| | *Rivea hypocrateriformis* Choisy | L | UA | # |
| Cucurbitaceae | *Coccinia grandis* (L.) Voigt | CL | UA | # |
| | *Corallocarpus epigaeus* (Rottler) Benth. and Hook. f. ex C.B. Clarke | CL | UA | CET 441 |
| | *Ctenolepis garcinii* (Burm. f.) C.B. Clarke | CL | UA | CET 452 |
| | *Cucumis melo* L. | CL | UA | # |
| | *Diplocyclos palmatus* (L.) Jeffrey | CL | UA | # |
| | *Luffa cylindrica* (L.) M. Roem. | CL | UA | # |
| | *Momordica charantia* L. var. *charantia* | CL | UA | # |
| | *Mukia maderaspatana* (L.) M. Roem. | CL | UA | # |
| | *Solena amplexicaulis* (Lam.) Gandhi | CL | UA | # |
| Cyperaceae | *Bulbostylis barbata* (Rottb.) C.B. Clarke | SD | UA | # |
| | *Cyperus clarkei* T. Cooke | SD | UA | CET 420 |
| | *Cyperus distans* L. f. | SD | UA | # |
| | *Cyperus iria* L. | SD | UA | # |
| | *Cyperus rotundus* L. subsp. *rotundus* | SD | UA | # |
| | *Fimbristylis argentea* (Rottb.) Vahl | SD | UA | # |
| | *Fimbristylis dichotoma* (L.) Vahl subsp. *dichotoma* | SD | UA | # |
| | *Fimbristylis miliacea* (Thunb.) Vahl | SD | UA | # |
| | *Fimbristylis ovata* (Burm. f.) J. Kern | SD | UA | CET 443 |
| | *Kyllinga nemoralis* (J.R. Forst. and G. Forst.) Dandy ex Hutch. and Dalziel | SD | UA | # |
| | *Lipocarpha raynaleana* Govind. | SD | UA | # |
| | *Mariscus paniceus* Vahl | SD | UA | # |
| | *Pycreus pumilus* (L.) Nees | SD | UA | # |
| Dioscoreaceae | *Dioscorea pentaphylla* L. | CL | UA | # |
| Droseraceae | *Drosera burmannii* Vahl | H | UA | CET 440 |
| | *Drosera indica* L. | H | UA | CET 444 |
| Ebenaceae | *Diospyros chloroxylon* Roxb. | T | UA | # |
| | *Diospyros ferrea* (Willd.) Bakh. var. *buxifolia* (Rottb.) Bakh. | SH | UA | # |
| | *Diospyros melanoxylon* Roxb. | T | UA | # |
| Eriocaulaceae | *Eriocaulon quinquangulare* L. | H | UA | # |
| Euphorbiaceae | *Acalypha indica* L. | H | UA | # |
| | *Acalypha lanceolata* Willd. | H | UA | # |
| | *Croton bonplandianus* Baill. | H | UA | # |
| | *Drypetes sepiaria* (Wight and Arn.) Pax and Hoffm. | T | UA | # |
| | *Euphorbia antiquorum* L. | SH | A | # |
| | *Euphorbia corrigioloides* Boiss. | H | UA | # |
| | *Euphorbia hirta* L. | H | UA | # |
| | *Euphorbia indica* Lam. | H | UA | # |
| | *Euphorbia tirucalli* L. | SH | UA | # |
| | *Jatropha gossypiifolia* L. | SH | UA | # |
| | *Micrococca mercurialis* (L.) Benth. | H | UA | # |
| | **Pedilanthus tithymaloides* (L.) Poit. | US | UA | # |
| | *Ricinus communis* L. | SH | UA | # |
| | *Sauropus bacciformis* (L.) Airy Shaw | H | UA | CET 453 |
| | *Sebastiania chamaelea* (L.) Müll. Arg. | H | UA | # |
| | *Securinega leucopyrus* (Willd.) Müll. Arg. | SH | UA | # |
| | *Tragia involucrata* L. var. *involucrata* | CL | UA | # |
| Fabaceae | *Abrus precatorius* L. | CL | UA | # |
| | **Acacia auriculiformis* A. Cunn ex Benth. | T | A | # |
| | *Acacia caesia* (L.) Willd. | SH | A | # |
| | *Acacia ferruginea* DC. | T | A | # |
| | **Acacia leucophloea* Willd. | T | A | # |
| | *Acacia planifrons* Wight and Arn. | T | A | # |
| | *Aeschynomene aspera* L. | H | UA | # |
| | *Aeschynomene indica* L. | H | UA | # |

**Table 1.** ***Continued.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| | *Albizia lebbeck* (L.) Benth. | T | UA | # |
| | *Alysicarpus monilifer* (L.) DC. | H | UA | # |
| | *Alysicarpus ovalifolius* (Schumac) J. Leonard. | H | UA | # |
| | *Bauhinia racemosa* Lam. | T | UA | # |
| | *Butea monosperma* (Lam.) Taub. | T | UA | # |
| | *Cajanus scarabaeoides* (L.) Thouars | CL | UA | # |
| | *Canavalia virosa* (Roxb.) Wight and Arn. | CL | UA | # |
| | *Cassia absus* L. | H | UA | # |
| | *Cassia auriculata* L. | SH | UA | # |
| | *Cassia fistula* L. | T | UA | # |
| | *Cassia hirsuta* L. | US | UA | # |
| | *Cassia mimosoides* L. | H | UA | CET 412 |
| | *Cassia occidentalis* L. | US | UA | # |
| | *Cassia pumila* Lam. | H | UA | CET 439 |
| | *Cassia roxburghii* DC. | T | UA | # |
| | *Cassia siamea* Lam. | T | UA | # |
| | *Cassia tora* L. | US | UA | # |
| | *Clitoria ternatea* L. | CL | UA | # |
| | *Crotalaria hebecarpa* (DC.) Rudd | H | UA | # |
| | *Crotalaria juncea* L. | US | UA | # |
| | *Crotalaria medicaginea* Lam. var. *medicaginea* | H | UA | CET 448 |
| | *Crotalaria pallida* Aiton var. *pallida* | US | UA | # |
| | *Crotalaria prostrata* Rottler ex Willd. | H | UA | # |
| | *Crotalaria retusa* L. | US | UA | # |
| | *Crotalaria verrucosa* L. | US | UA | # |
| | *Dalbergia lanceolaria* L. | T | UA | # |
| | **Dalbergia sissoo* Roxb. ex DC. | T | UA | # |
| | **Delonix regia* (Boj. ex Hook) Raf. | T | UA | # |
| Fabaceae | *Desmodium tortuosum* (Sw.) DC. | US | UA | # |
| | *Desmodium triflorum* (L.) DC. | H | UA | # |
| | *Dicerma biarticulatum* (L.) DC. | H | UA | # |
| | *Dichrostachys cinerea* (L.) Wight and Arn. | T | UA | # |
| | **Enterolobium cyclocarpum* (Jack.) Griseb. | T | UA | # |
| | *Erythrina suberosa* Roxb. | T | A | # |
| | *Gliricidia sepium* (Jacq.) Kunth ex Walp. | T | UA | # |
| | *Hardwickia binata* Roxb. | T | UA | # |
| | *Indigofera aspalathoides* M. Vahl ex DC. | H | UA | # |
| | *Indigofera linifolia* (L. f.) Retz. | H | UA | CET 398 |
| | *Indigofera linnaei* Ali | H | UA | # |
| | *Indigofera tinctoria* L. | H | UA | # |
| | *Indigofera trifoliata* L. | H | UA | # |
| | *Leucaena leucocephala* (Lam.) De Wit | T | UA | # |
| | *Mimosa intsia* L. | SH | A | # |
| | *Mimosa pudica* L. | H | A | # |
| | **Peltophorum pterocarpum* (DC.) Backer ex K. Heyne | T | UA | # |
| | *Pithecellobium dulce* (Roxb.) Benth. | T | A | # |
| | *Pongamia pinnata* (L.) Merr. | T | UA | # |
| | *Prosopis juliflora* (Sw.) DC. | T | A | # |
| | *Pseudarthria viscida* (L.) Wight and Arn. | H | UA | # |
| | *Pterolobium hexapetalum* Santapau and Wagh | SH | A | # |
| | *Pycnospora lutescens* (Poir.) Schindl. | CL | UA | # |
| | *Rhynchosia aurea* (Rottler) DC. | CL | UA | # |
| | *Rhynchosia rufescens* (Willd.) DC. | CL | UA | # |
| | *Stylosanthes fruticosa* (Retz.) Alston | H | UA | # |
| | **Tamarindus indica* L. | T | UA | # |
| | *Tephrosia maxima* Pres. | H | UA | CET 446 |
| | *Tephrosia pumila* (Lam.) Pers. | H | UA | # |

**Table 1.** ***Continued.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Fabaceae | *Tephrosia purpurea* (L.) Pers. | H | UA | # |
| | *Tephrosia villosa* (L.) Pers. | H | UA | # |
| | *Teramnus labialis* (L. f.) Spreng. | H | UA | # |
| | *Zornia diphylla* (L.) Pers. | H | UA | # |
| Gentianaceae | *Canscora heteroclita* (L.) Gilg | H | UA | # |
| | *Enicostema axillare* (Lam.) A. Raynal | H | UA | CET 366 |
| Hydrocharitaceae | *Hydrilla verticillata* (L. f.) Royle | H | UA | # |
| | *Ottelia alismoides* (L.) Pers. | H | UA | # |
| Hydroleaceae | *Hydrolea zeylanica* (L.) Vahl | H | UA | CET 450 |
| Hypoxidaceae | *Curculigo orchioides* Gaertn. | H | UA | # |
| Lamiaceae | *Anisomeles indica* (L.) Kuntze | US | UA | # |
| | *Anisomeles malabarica* (L.) R. Br. ex Sims | SH | UA | # |
| | *Basilicum polystachyon* (L.) Moench | H | UA | # |
| | *Geniosporum tenuiflorum* Merr. | H | UA | CET 372 |
| | *Gmelina asiatica* L. | SH | UA | # |
| | *Hyptis suaveolens* (L.) Poit. | US | UA | # |
| | *Leucas aspera* (Willd.) Link | H | UA | # |
| | *Leucas biflora* (Vahl) R. Br. ex Sm. | H | UA | CET 383 |
| | *Leucas diffusa* Benth. | H | UA | # |
| | *Leucas indica* (L.) R. Br. ex Sm. | H | UA | # |
| | *Ocimum adscendens* Willd. | H | UA | # |
| | *Ocimum americanum* L. | H | UA | # |
| | *Ocimum tenuiflorum* L. | US | UA | # |
| | *Orthosiphon thymiflorus* (Roth) Sleensen | H | UA | CET 374 |
| | *Premna corymbosa* (Burm.f.) Rottler. and Willd. | SH | UA | # |
| | *Premna tomentosa* Willd. | SH | UA | # |
| | *Tectona grandis* L.f. | T | UA | # |
| | *Vitex negundo* L. var. *negundo* | SH | UA | # |
| Lauraceae | *Cassytha filiformis* L. | C | UA | # |
| Lecythidaceae | **Barringtonia acutangula* (L.) Gaertn. | T | UA | # |
| Lentibulariaceae | *Utricularia caerulea* L. | H | UA | # |
| | *Utricularia graminifolia* Vahl | H | UA | CET 455 |
| | *Utricularia polygaloides* Edgew. | H | UA | # |
| | *Utricularia scandens* Benj. | H | UA | # |
| Liliaceae | *Iphigenia indica* (L.) A. Gray ex Kunth | H | UA | CET 423 |
| Linderniaceae | *Lindernia ciliata* (Colsm.) Pennell | H | UA | # |
| | *Lindernia crustacea* (L.) F. Muell. | H | UA | # |
| | *Lindernia oppositifolia* (L.) Mukerjee | H | UA | CET 430 |
| | *Lindernia parviflora* (Roxb.) Haines | H | UA | # |
| Linaceae | *Hugonia mystax* L. | L | UA | # |
| Loganiaceae | *Strychnos lenticellata* A.W. Hill | L | UA | # |
| Lythraceae | *Ammania baccifera* L. subsp. *baccifera* | H | UA | # |
| | *Rotala rosea* (Poir.) C.D.K. Cook | H | UA | # |
| | *Rotala verticillaris* L. | H | UA | # |
| Malvaceae | *Abutilon hirtum* (Lam.) Sweet | SH | UA | # |
| | *Abutilon indicum* (L.) Sweet | SH | UA | # |
| | *Corchorus aestuans* L. | H | UA | # |
| | **Guazuma ulmifolia* Lam. | T | UA | # |
| | *Grewia hirsuta* Vahl. | SH | UA | # |
| | *Grewia orientalis* L. | SH | UA | # |
| | *Helicteres isora* L. | SH | UA | # |
| | *Hibiscus micranthus* L. f. | US | UA | # |
| | **Hibiscus rosa-sinensis* L. | SH | UA | # |
| | *Hibiscus vitifolius* L. | US | UA | # |
| | *Malvastrum coromandelianum* (L.) Garcke | US | UA | # |
| | *Melochia corchorifolia* L. | H | UA | # |
| | *Pavonia odorata* Willd. | H | UA | # |

**TABLE 1.** ***CONTINUED.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Malvaceae | *Pavonia zeylanica* (L.) Cav. | H | UA | # |
| | *Sida acuta* Burm. f. | H | UA | # |
| | *Sida cordata* (Burm. f.) Borss. Waalk. | H | UA | # |
| | *Sida cordifolia* L. | US | UA | # |
| | *Sida schimperiana* Hochst. ex A. Rich. | US | UA | # |
| | *Thespesia populnea* (L.) Sol. ex Corrêa | T | UA | # |
| | *Triumfetta rhomboidea* Jacq. | US | UA | # |
| | *Urena lobata* L. subsp. *sinuata* (L.) Borss. Waalk | US | UA | # |
| | *Waltheria indica* L. | H | UA | # |
| Melastomataceae | *Memecylon edule* Roxb. | SH | UA | # |
| | *Memecylon umbellatum* Burm. f. | SH | UA | # |
| | *Osbeckia zeylanica* Steud. ex Naudin | H | UA | CET 406 |
| Meliaceae | *Azadirachta indica* A. Juss. | T | UA | # |
| Menispermaceae | *Cissampelos pareira* L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman | CL | UA | # |
| | *Pachygone ovata* (Poir.) Diels. | CL | UA | # |
| | *Tiliacora acuminata* Miers | L | UA | # |
| | *Tinospora cordifolia* (Willd.) Miers | CL | UA | # |
| Molluginaceae | *Glinus oppositifolius* (L.) Aug. DC. | H | UA | # |
| | *Mollugo nudicaulis* Lam. | H | UA | # |
| | *Mollugo pentaphylla* L. | H | UA | # |
| Moraceae | *Ficus amplissima* Sm. | T | UA | # |
| | *Ficus benghalensis* L. var. *benghalensis* | T | UA | # |
| | *Ficus hispida* L. f. | SH | UA | # |
| | *Ficus racemosa* L. | T | UA | # |
| | *Ficus religiosa* L. | T | UA | # |
| | *Streblus asper* Lour. | T | UA | # |
| Muntingiaceae | **Muntingia calabura* L. | T | UA | # |
| Myrtaceae | **Eucalyptus tereticornis* Sm. | T | UA | # |
| | **Psidium guajava* L. | T | UA | # |
| | *Syzygium cumini* (L.) Skeels | T | UA | # |
| Nyctaginaceae | *Boerhavia diffusa* L. | H | UA | # |
| | *Boerhavia erecta* L. | H | UA | CET 401 |
| Nympheaceae | *Nymphaea pubescens* Willd. | H | UA | # |
| | *Nymphaea nouchali* Burm. f. | H | UA | # |
| Ochnaceae | *Ochna squarrosa* L. | SH | UA | # |
| Oleaceae | *Jasminum angustifolium* Willd. var. *angustifolium* | CL | UA | # |
| Onagraceae | *Ludwigia adscendens* (L.) H. Hara | H | UA | # |
| | *Ludwigia perennis* L. | H | UA | # |
| Opiliaceae | *Cansjera rheedei* J.F. Gmel. | SH | UA | # |
| Orchidaceae | *Eulophia epidendraea* C.E.C. Fisch. | H | UA | # |
| | *Habenaria viridiflora* (Rottl. ex Sw.) R. Br. | H | UA | CET 449 |
| Orobanchaceae | *Striga angustifolia* (D.Don) C.J. Saldanha | H | UA | # |
| Passifloraceae | *Passiflora foetida* L. | CL | UA | # |
| | *Turnera subulata* Sm. | US | UA | # |
| Pedaliaceae | *Pedalium murex* L. | H | UA | CET 451 |
| Phyllanthaceae | *Breynia vitis-idaea* (Burm.f.) C.E.C. Fisch. | SH | UA | # |
| | *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f. | SH | UA | # |
| | *Phyllanthus amarus* Schumach and Thonn. | H | UA | # |
| | *Phyllanthus debilis* Klein ex Willd. | H | UA | # |
| | **Phyllanthus emblica* L. | T | UA | # |
| | *Phyllanthus maderaspatensis* L. | H | UA | # |
| | *Phyllanthus reticulatus* Poir. | SH | UA | # |
| | *Phyllanthus virgatus* G. Forst. | H | UA | # |
| Plantaginaceae | *Bacopa floribunda* (R. Br.) Wettst. | H | UA | CET 424 |
| | *Dopatrium junceum* (Roxb.) Buch.-Ham ex Benth. | H | UA | # |
| | *Limnophila indica* (L.) Druce | H | UA | # |
| | *Scoparia dulcis* L. | H | UA | # |

**Table 1.** ***Continued.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Plumbaginaceae | *Plumbago zeylanica* L. | H | UA | # |
| Poaceae | *Alloteropsis cimicina* (L.) Stapf | G | UA | CET 361 |
| | *Andropogon pumilus* Roxb. | G | UA | CET 368 |
| | *Apluda mutica* L. | G | UA | CET 363 |
| | *Aristida adscensionis* L. | G | UA | # |
| | *Aristida hystrix* L. f. | G | UA | CET 380 |
| | *Aristida setacea* Retz. | G | UA | # |
| | *Axonopus compressus* (Sw.) P. Beauv. | G | UA | CET 371 |
| | *Bothriochloa pertusa* (L.) A. Camus | G | UA | CET 364 |
| | *Brachiaria distachya* (L.) Stapf | G | UA | CET 379 |
| | *Brachiaria remota* (Retz.) Haines | G | UA | # |
| | *Chloris barbata* Sw. | G | UA | # |
| | *Chloris montana* Roxb. | G | UA | CET 370 |
| | *Chrysopogon asper* (B. Heyne) Heyne ex Blatter and McCann | G | UA | # |
| | *Chrysopogon fulvus* (Spreng) Choiv. | G | UA | CET 362 |
| | *Cymbopogon travancorensis* Bor | G | UA | CET 367 |
| | *Cynodon barberi* Rang. and Tadul. | G | UA | CET 381 |
| | *Cynodon dactylon* (L.) Pers. | G | UA | # |
| | *Cyrtococcum trigonum* (Retz.) A. Camus | G | UA | CET 377 |
| | *Dactyloctenium aegyptium* (L.) Willd. | G | UA | # |
| | *Desmostachya bipinnata* (L.) Stapf | G | UA | CET 382 |
| | *Dichanthium annulatum* (Forssk.) Stapf | G | UA | CET 375 |
| | *Dichanthium caricosum* (L.) A. Camus | G | UA | CET 392 |
| | *Digitaria ciliaris* (Retz.) Koeler | G | UA | CET 384 |
| | *Dimeria acutipes* Bor | G | UA | CET 408 |
| | *Eleusine indica* (L.) Gaertn. | G | UA | # |
| | *Enteropogon monostachyos* (Vahl) K. Schum ex Engl. | G | UA | CET 376 |
| | *Eragrostiella bifaria* (Vahl) Bor | G | UA | CET 400 |
| | *Eragrostiella brachyphylla* (Stapf.) Bor | G | UA | CET 447 |
| | *Eragrostis gangetica* (Roxb.) Steud. | G | UA | CET 407 |
| | *Eragrostis macilenta* (A. Rich) Steud. | G | UA | CET 402 |
| | *Eragrostis nutans* (Retz.) Nees ex Steud. | G | UA | CET 403 |
| | *Eragrostis tenella* (L.) P. Beauv ex Roem. and Schult. var. *tenella* | G | UA | # |
| | *Eragrostis tenella* (L.) P. Beauv. ex Roem. and Schult. var. *insularis* C.E. Hubb. | G | UA | # |
| | *Eragrostis unioloides* (Retz.) Nees ex Steud. | G | UA | CET 404 |
| | *Eragrostis viscosa* (Retz.) Trin. | G | UA | CET 405 |
| | *Heteropogon contortus* (L.) P. Beauv. ex Roem. and Schult. | G | UA | CET 388 |
| | *Heteropogon polystachyus* (Roxb.) Schult. | G | UA | CET 395 |
| | *Iseilema prostratum* (L.) Andersson | G | UA | CET 365 |
| | *Leptochloa uniflora* Hochst ex A. Rich. | G | UA | CET 421 |
| | *Mnesithea laevis* (Retz.) Kunth | G | UA | CET 411 |
| | *Oplismenus compositus* (L.) P. Beauv | G | UA | CET 409 |
| | *Panicum psilopodium* Trin. | G | UA | CET 433 |
| | *Paspalidium flavidum* (Retz.) A. Camus | G | UA | CET 416 |
| | *Paspalum distichum* L. | G | UA | CET 425 |
| | *Paspalum scrobiculatum* L. | G | UA | CET 393 |
| | *Perotis indica* (L.) Kuntze var. *indica* | G | UA | CET 373 |
| | *Setaria pumila* (Poir.) Roem. and Schult. | G | UA | CET 399 |
| | *Setaria verticillata* (L.) P. Beauv | G | UA | CET 397 |
| | *Sporobolus coromandelianus* (Retz.) Kunth | G | UA | CET 428 |
| | *Sporobolus indicus* (L.) R. Br. var. *diandrus* (Retz.) Jovet and Guédès | G | UA | CET 454 |
| | *Tragus roxburghii* Panigrahi | G | UA | CET 386 |
| | *Vetiveria zizanioides* (L.) Nash | G | UA | CET 369 |
| Polygalaceae | *Polygala arvensis* Willd. | H | UA | CET 422 |
| Portulacaceae | *Portulaca quadrifida* L. | H | UA | CET 431 |
| | *Portulaca oleracea* L. | H | UA | # |
| Rhamnaceae | *Scutia myrtina* (Burm. f.) Kurz | SH | A | # |

**TABLE 1.** ***CONTINUED.***

| FAMILY | SPECIES | HABIT | ARMATURE | VOUCHER NUMBER |
|---|---|---|---|---|
| Rhamnaceae | *Ventilago maderaspatana* Gaertn. | L | UA | # |
| | **Ziziphus mauritiana* Lam. var. *mauritiana* | T | A | # |
| | *Ziziphus oenopolia* (L.) Mill. | SH | A | # |
| | *Ziziphus xylopyrus* Willd. | T | A | # |
| Rubiaceae | *Benkara malabarica* (L.) Tirveng. | SH | A | # |
| | *Canthium parviflorum* Lam. | SH | A | # |
| | *Catunaregam spinosa* (Thunb.) Tirveng. | SH | A | # |
| | *Dentella repens* (L.) J.R. Forst. and G. Forst. | H | UA | # |
| | *Hedyotis affinis* Roem. and Schult. | H | UA | CET 426 |
| | *Hedyotis biflora* (L.) Lam. | H | UA | CET 387 |
| | *Hedyotis brachiata* Wight | H | UA | # |
| | *Hedyotis corymbosa* (L.) Lam. | H | UA | CET 394 |
| | *Hedyotis herbacea* L. | H | UA | CET 391 |
| | *Hedyotis puberula* (G. Don) Arn. | H | UA | CET 429 |
| | *Ixora pavetta* Andrews | T | UA | # |
| | *Mitracarpus villosus* (Sw.) DC. | H | UA | CET 390 |
| | *Morinda pubescens* Sm. | T | UA | # |
| | *Psilanthus wightianus* (Wall. ex Wight and Arn.) J.-F.Leroy | T | UA | # |
| | *Psydrax dicoccos* Gaertn. var. *dicoccos* | SH | UA | # |
| | *Richardia scabra* L. | H | UA | CET 427 |
| Rubiaceae | *Spermacoce articularis* L.f. | H | UA | # |
| | *Spermacoce hispida* L. | H | UA | # |
| | *Tarenna asiatica* Kuntze ex K. Schum. var. *asiatica* | SH | UA | # |
| Rutaceae | *Atalantia monophylla* DC. | T | A | # |
| | *Glycosmis mauritiana* (Lam.) Tanaka | SH | UA | # |
| | *Toddalia asiatica* (L.) Lam. | SH | A | # |
| Salicaceae | *Flacourtia indica* (Burm. f.) Merr. | SH | A | # |
| Santalaceae | *Santalum album* L. | T | UA | # |
| Sapindaceae | *Allophylus cobbe* (L.) Raeusch. | SH | UA | # |
| | *Cardiospermum halicacabum* L. | CL | UA | # |
| | *Dodonaea viscosa* (L.) Jacq. | SH | UA | # |
| | *Lepisanthes tetraphylla* Radlk. | T | UA | # |
| | *Sapindus emarginatus* Vahl | T | UA | # |
| Sapotaceae | *Madhuca longifolia* (J. König ex L.) J.F. Macbr. | T | UA | # |
| | *Manilkara hexandra* (Roxb.) Dubard | T | UA | # |
| Solanaceae | *Datura innoxia* Mill. | US | UA | # |
| | *Datura metel* L. | US | UA | # |
| | *Physalis angulata* L. | H | UA | # |
| | *Physalis lagascae* Roem. and Schult. | H | UA | # |
| | *Solanum americanum* Mill. | H | UA | # |
| | *Solanum torvum* Sw. | SH | A | # |
| | *Solanum trilobatum* L. | CL | A | # |
| | *Solanum virginianum* L. | H | A | # |
| Typhaceae | *Typha angustifolia* L. | SD | UA | # |
| Ulmaceae | **Holoptelea integrifolia* Planch. | T | UA | # |
| Verbenaceae | *Lantana camara* L. var. *aculeata* (L.) Moldenke. | SH | UA | # |
| | *Phyla nodiflora* (L.) Greene | H | UA | # |
| | *Stachytarpheta jamaicensis* (L.) Vahl | H | UA | # |
| Violaceae | *Hybanthus enneaspermus* (L.) F. Muell. | H | UA | # |
| Vitaceae | *Cissus quadrangularis* L. | SH | UA | # |
| | *Cissus vitiginea* L. | L | UA | # |
| Xyridaceae | *Xyris pauciflora* Willd. | H | UA | # |
| Zygophyllaceae | *Tribulus lanuginosus* L. | H | UA | CET 378 |

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